Diagnosing learning disorders

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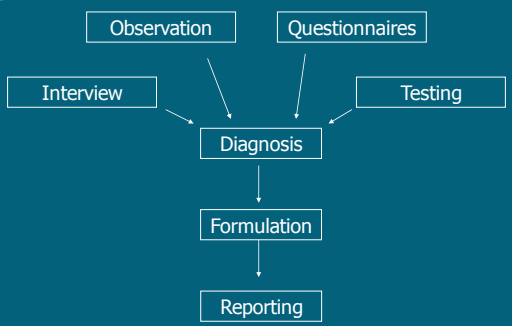
Overview

1. a taxonomy of developmental cognitive disorders
2. language disorders
3. reading disorders

Aims of assessment

- description of cognitive, behavioural, emotional, social functioning
- identification of cognitive deficits
  - nature
  - severity
- explanation of behaviour, emotional and social functioning
- planning management



Competencies

1. theory of cognition

Cognitive systems

- perceptual systems
- motor functions
- language
- memory
- spatial processing
- attention & executive functions
- quantitative
- social cognition

Competencies

1. theory of cognition
2. psychological assessment
   - test administration and interpretation
   - psychometrics

Tests

- intelligence
- language
- reading, spelling and writing
- arithmetic
- memory
- spatial abilities
- executive functions

Test knowledge

- normative data
- psychometrics
  - reliability
  - validity
- administration & scoring
- interpretation

Competencies

1. theory of cognition
2. psychological assessment
   - test administration and interpretation
   - psychometrics
3. knowledge of common disorders
   - cognitive profile
   - epidemiology

Developmental cognitive disorders

- intellectual disability
- sensory impairments
  - visual impairment
  - auditory impairment
- motor disorders
- learning disorders
  - language disorders
  - dyslexias (reading disorders)
  - dysgraphias (spelling - writing disorders)
  - dyscalculias (arithmetic disorders)
- attention-deficit hyperactivity disorder
- autistic spectrum disorders
- other disorders

The WISC-IV

Interpretation

- FSIQ
- factors
- subtests

- relationship with other measures

IQ as predictor

- academic achievement (~ .70)
- psychosocial adjustment
- educational outcome
- adult IQ (~ .50)
- adult educational or occupational status (~ .50)

Factors affecting IQ

- language
- years of schooling
- race / ethnicity
- socio-economic status
- parental occupation
- family attitudes & values (eg achievement)
- parental education

Step 1 : Analyse FSIQ

- check confidence interval
- compare with other estimates of intelligence
  - other tests
  - teacher estimates
  - general functioning
- interpret FSIQ as a measure of general abilities

Step 1 : FSIQ

- Q: does this score provide a valid indicator (descriptor) of relevant aspects of child's functioning? (or, when is it invalid, or irrelevant?)

- developmental disability
- low IQ

Case 1

- 9 year old girl
- previously assessed to have developmental disability
- retest for placement purposes

Case 1

WISC-IV	Composite	90% CI	%ile	
VC	55	52-63	0.1	
PR	51	48-61	0.1	
WM	54	51-64	0.1	
PS	53	51-66	0.1	
FS	44	42-50	< 0.1	

Case 1	Score	90% CI	%ile
Communication	1		
Community Use	1		
Functional Academics	1		
Home Living	1		
Health and Safety	4		
Leisure	4		
Self-Care	1		
Self-Direction	1		
Social	1		
Global Adaptive Comp.	46	44-49	< 0.1

Case 2

- 7 year old boy
- previous diagnosis of language disorder

Case 2

WISC-IV	Composite	90% CI	%ile	
VC	71	67-78	3	
PR	69	65-78	2	
WM	59	56-69	0.3	
PS	75	70-86	5	
FS	62	59-67	1	

Case 2 : ABAS	Score	90% CI	%ile
Communication	3		
Community Use	6		
Functional Academics	2		
Home Living	5		
Health and Safety	7		
Leisure	4		
Self-Care	7		
Self-Direction	5		
Social	4		
Global Adaptive Comp.	68	66-71	1.6

Case 3

- 6 year old girl
- reported advanced language development

Case 3

WISC-IV	Composite	90% CI	%ile	
VC	136	128-140	99	
PR	139	129-142	99.5	
WM	126	117-130	96	
PS	133	122-137	99	
FS	144	139-147	99.8	

GRS	T-Score	90% CI	%ile	
intellectual	> 80		99	
academic	> 80		99	
creativity	76		99	
artistic	74		99	
leadership	69		98	
motivation	> 80		99	

Summary

- intelligence tests provide
  - estimate of general abilities or "IQ"
  - information about specific cognitive domains

Limitations of IQ

- IQ is a composite score, an average of scores across a number of cognitive domains
- obscures variability in cognitive performance
- unable to identify assets or deficits in domains not included in battery

Interpretation

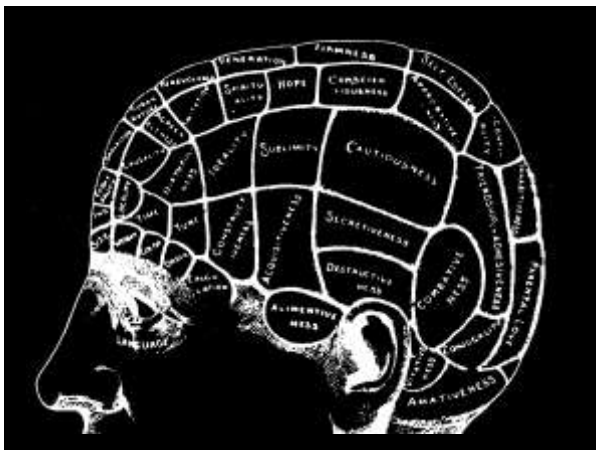
- Step 2 : Analyse the factors

What do the factors tell us?

Cognition

Mind & body

- Empedocles (490-430 BCE)
- Plato (420-347 BCE)
- Hippocrates (430-379 BCE)
- Aristotle (384-322 BCE)
- Galen (129-199)
- Descartes (1596-1650)
- Gall (1758-1828) & Spurzheim (1776-1832)



Factor-analytic models

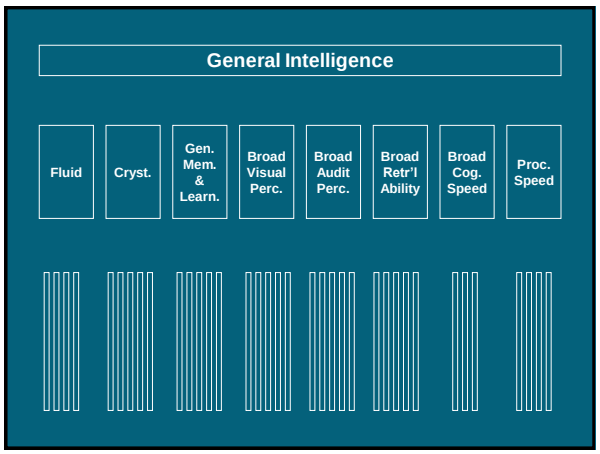
- Binet
- Spearman
- Thurstone
- Guilford
- Vernon
- Cattell
- Horn

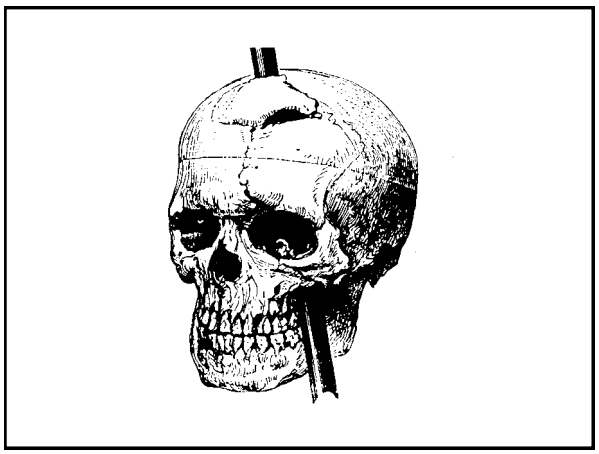
Thurstone (1931)

- space
- perceptual speed
- number facility
- verbal relations
- word fluency
- memory
- induction

Horn-Cattell Gf-Gc model

- Gv visuo-spatial
- Ga auditory thinking
- Gc crystallised
- Gsm short-term acquisition and retrieval
- Glr long-term acquisition and retrieval
- Gf fluid reasoning (executive)
- Gs cognitive processing speed
- Gt correct decision speed
- Grw reading-writing
- Gq quantitative





Cognitive systems

- perceptual systems
- motor functions
- language
- memory
- spatial processing
- attention & executive functions
- quantitative
- social cognition

perceptual	visual object recognition	memory	verbal working
	face recognition		verbal learning
	colour recognition		retrieval
	auditory		visuospatial working
	tactile		visuospatial learning
crystallised	general knowledge	attention & executive functions	selective attention
oral language	phonology		sustained attention
	grammar		switching attention
	semantics		behavioural inhibition
	pragmatics		executive functions
written language	grapheme recognition	spatial	visuospatial
	grapheme-phoneme conv.	quantitative	arithmetic
	word recognition	social cognition	social perception
	word comprehension		social reasoning
	text comprehension		social expression
	spelling		emotional
	writing	motor	simple motor
speed	visuomotor speed		complex motor

Verbal Comprehension

- verbal reasoning
  - language
  - executive functions

Perceptual Reasoning

- "nonverbal reasoning"
  - executive functions
  - visual perception
  - language

Working Memory

- verbal working memory
  - phonology
  - working memory

Processing Speed

- visuo-motor speed
  - visual perception
  - motor skills
- orthographic skills
  - phonology

WISC-IV and diagnosis

- WISC-IV factors estimate level of ability in areas of cognition
- low score on a factor invites the hypothesis of deficit in some area of cognition

Analyse factors

- establish confidence interval
- examine other estimates of abilities
- interpret factors as measures of specific abilities

Index score differences

- statistical significance
- frequency
  - direction of difference
  - ability level

Step 2 : WM

- Q: does the child exhibit difficulties in phonological aspects of language?

- hypotheses
  - reading disorder
  - language disorder

Step 3 : VC

- Q: is there evidence of difficulties with verbal reasoning?
- hypotheses
  - language disorder
  - dysexecutive problems

Step 4 : PR

- Q: is there evidence of difficulties with nonverbal reasoning?
- hypotheses
  - ADHD
  - dysexecutive problems

Step 5 : PS

- Q: is there evidence of difficulties with visual perception or simple motor skills?
- hypotheses
  - developmental motor disorder

Step 6 : other information

- Q: is other information consistent with hypotheses regarding
  - deficits (symptoms)
  - disorder (syndrome)
- test results
- history
- observation

Case 4

- 11 year old boy
- history of difficulties with acquisition of reading skills
- differential diagnosis reading disorder or language disorder

Case 4

WISC-IV	Composite	90% CI	%ile	
VC	69	65-77	2	
PR	119	111-124	90	
WM	83	78-91	13	
PS	97	90-105	42	
FS	89	85-93	23	

Case 4

WISC-IV	Composite	90% CI	%ile	
VC	69	65-77	2	X
PR	119	111-124	90	
WM	83	78-91	13	X
PS	97	90-105	42	
FS	89	85-93	23	

Case 4

- hypotheses
  - language disorder
  - reading disorder
- testing hypotheses
  - language test
  - reading test

WIAT-II	Score	90% CI	%ile	
Wd Rdg	76	72-80	5	
Ps Dec	80	76-84	9	
Rdg Com	61	56-66	0.5	
Spelling	69	63-75	2	
Writ Exp	79	70-88	8	
Num Op	56	45-67	0.2	
Math Reas	66	50-73	1	
List Comp	73	63-83	4	
Oral Exp	63	55-71	1	

WIAT-II	Score	90% CI	%ile	
Wd Rdg	76	72-80	5	X
Ps Dec	80	76-84	9	X
Rdg Com	61	56-66	0.5	X
Spelling	69	63-75	2	X
Writ Exp	79	70-88	8	X
Num Op	56	45-67	0.2	X
Math Reas	66	50-73	1	X
List Comp	73	63-83	4	X
Oral Exp	63	55-71	1	X

CELF-4	Score	90% CI	%ile	
CLS	70	64-76	2	
RLI	65	57-73	1	
ELI	67	60-74	1	
LCI	70	63-77	2	
LMI	72	65-79	3	
PA	< crit.			

CELF-4	Score	90% CI	%ile	
CLS	70	64-76	2	X
RLI	65	57-73	1	
ELI	67	60-74	1	
LCI	70	63-77	2	
LMI	72	65-79	3	
PA	< crit.			X

Reporting scores

Learning objectives

- understand the properties/accuracy of test scores
- report test scores in an accurate, meaningful way which reduces misuse and misinterpretation

Questions

- How precise are test scores?
- Should scores be reported? If so, how?
- Should ranges be reported?

Scores, percentiles and ranges

Numbers

- a client's performance produces a raw score, which is converted to a standard score
- the standard score enables the psychologist to compare the performance to those of peers

"On the WAIS-IV, Mr Smith obtained a score of 94"

"John's performance on the WISC-IV produced a score of 110"

"Ms Johnson's Full Scale Intelligence Quotient was 85"

Numbers

- standard scores do not provide a direct comparison of performance with that of peers
- standard scores are not well understood by non-psychologists, and may be misinterpreted

Percentiles

- enable a client's test performance to be directly compared with peer performance, both by psychologists and non-psychologists

"On the WAIS-IV, Mr Smith obtained a percentile of 34"

"John's performance on the WISC-IV was at the 75th percentile"

"Ms Johnson's Full Scale Intelligence Quotient was at the 16th percentile"

Percentiles

- not easily employed in statistical analyses
  - cannot be averaged across areas
  - consideration of difference between two tests more difficult when using percentiles, as meaning of difference varies with overall level

Ranges

- a statement of the range in which the test performance may be placed
  - eg Average, Low Average, Borderline, Superior, Above Average
- the use of ranges may be quite informative for readers, as allows direct comparison with peers in a descriptive way

IQ ranges

IQ	%ile	Classification
130 »	97 »	gifted
120 – 129	91 – 96	well above ave
111 – 119	76 – 90	above average
90 – 110	25 – 75	average
81 – 89	10 – 24	low average
71 – 80	3 – 9	well below ave
« 70	« 2	int. disability

"On the WAIS-IV, Mr Smith's performance was in the Average range"

"John's performance on the WISC-IV was in the Above Average range"

"Ms Johnson's Full Scale Intelligence Quotient was in the Low Average range"

Ranges

- at junctures, ranges do not define markedly different levels of test performance, yet readers will interpret results in this way
- within range, implies homogeneity of performance, yet performance may differ in clinically significant ways
  - Average: 25th to 75th percentile
  - Borderline: 2nd to 9th percentile

Summary

- each of these methods provides a means of indicating test performance
- methods vary in how informative they are for readers
- may vary in potential for misunderstanding and misuse

Points, intervals and estimates

Precision vs approximation

- another major issue concerns the degree of precision implied in reports of test results, and clients' understanding of these reports
- test results are measures of performance, which provide estimates of competence, or level of ability

"On the WAIS-IV, Mr Smith obtained a score of 94"

Psychologists' understanding

"On the WAIS-IV, Mr Smith obtained a score of 94"

That means:

- Mr Smith's intellectual abilities are average for age
- this estimate may be of assistance in vocational guidance, or determining presence of specific cognitive disorders etc

Clients' understanding

"On the WAIS-IV, Mr Smith obtained a score of 94"

That means:

- my IQ is 94
- 66% of people are smarter than me
- my brother, whose IQ is 97, is smarter than me

The problem with points

- test reliability studies demonstrate the amount of error in measurement
- point scores (standard scores or percentiles) imply a degree of precision in measurement which does not exist
- one solution to this is to report scores as confidence intervals

Classical Test Theory

- for each "ability", each person has a particular level of skill
- we do not know the person's true level of ability (because we do not have a perfect test)
- an obtained score on a test is an estimate of a person's true level of ability
- an even better estimate of a person's true level of ability can be derived from the obtained score by taking into account regression to the mean

Estimated true scores

- we can derive an estimated "true score" for an individual from the obtained score, by taking into account the reliability of the test
- estimated true scores will always be closer to the mean than obtained scores (except where $r = 1$)

True score

$$X_T = r_{xx} (X_O - \bar{X}) + \bar{X}$$

Example

- an individual obtains a score of 84 on an intelligence test (mean = 100, sd = 15) with r = .8

$X_T = .8\ (84 - 100) + 100$

$X_T = 87.2$

Confidence intervals

- CI indicates range in which individual's true score probably lies
- CI established around true scores, using the standard error of estimate (SE_e)
- CI = X_T +/- z SE_e

Example

- X = 84
- X_T = 87.2

CI (%) = X_T +/- z SE_e

CI (.90) = 87.2 +/- (1.65) 6

= 77.3 - 97.1

Note

- there are several ways of deriving confidence intervals:
  - obtained score +/- SEM
  - true score +/- SEM
  - true score +/- SEE
- psychometricians debate the merits of each; we not explore this issue here

Confidence intervals

- a statement of the range in which a person's true level of ability probably lies, given the score obtained from their test performance, and taking into account the reliability of the test

"On the WAIS-IV, Mr Smith obtained a score in the range of 90 to 98"

"John's performance on the WISC-IV produced a score between 105 and 115"

"Ms Johnson's Full Scale Intelligence Quotient was somewhere between 83 and 93"

- "There is a 90% chance that Mr Smith's true abilities lie somewhere in the range between 90 and 98 (and a 10% chance his true abilities are either below 90 or above 98)"

Confidence intervals (numbers)

- acknowledge imprecision of test
- convey approximate test score, imply approximate level of ability
- may create confusion for non-psychologists

Confidence intervals - percentiles

- as percentiles are generally more informative than scores, Crawford proposed creating intervals with percentiles

"On the WAIS-IV, Mr Smith obtained a score in the range of the 30th to 47th percentiles"

"John's performance on the WISC-IV produced a score between the 63rd and 84th percentile"

"Ms Johnson's Full Scale Intelligence Quotient was somewhere between the 19th and 34th percentiles"

- "There is a 90% chance that Mr Smith's true abilities lie somewhere in the range between the 30th and 47th percentile (and a 10% chance his true abilities are either below the 30th percentile or above the 47th percentile)"

Summary

- confidence intervals are better than point scores in acknowledging that obtained score is an estimate
- percentiles are better than numbers at conveying information
- however, reports using CIs are likely to be confusing for many readers
- to date, psychologists have not used CIs with percentiles

Test scores, cognitive systems, and diagnoses

Test scores

- test scores are measures of performance, that provide estimates of a client's abilities
- test scores do not directly measure abilities

Scores and cognitive systems

"On the WAIS-IV, Ms Jones obtained a Verbal Comprehension score of 84. That means that she has problems with verbal comprehension."

- Sentences like this indicate a confusion between test scores and cognitive systems

Scores and diagnoses

"On the WMS-IV, Mr Jackson obtained a Memory Index of 75. That means that he has a memory disorder."

- sentences like this indicate a faulty interpretation of a test score as indicating a diagnosis

Scores, systems and diagnoses

Scores Systems Diagnoses

Conclusions

Principles

- test scores are estimates of a construct, based on performance
- reports should not imply that test scores are precise measurements of abilities
  - reporting obtained score
  - reporting exact percentile
- psychologists should not encourage misuse or misinterpretation of test scores

Issues

- several issues influence psychologists' decisions when reporting scores
  - purpose of the report
  - test score vs level of ability
  - implying precision vs approximation
  - provision of detail vs risk of misinterpretation

Guidelines

- do not report exact numbers or percentiles
- approximate percentiles are usually informative and at lower risk for misuse
- indicate approximate level of performance in descriptive manner
  - do not reify ranges
- ensure the summary section is clear, informative, and addresses all referral questions

Language

Key questions

- what is a language disorder?
- are there different types?
- do symptoms change over time?
- why do some children have a language disorder?
- how common is it?
- what is the nature of the impairment?
- how do we identify it?
- how do we distinguish this from other diagnoses?
- how do we treat it?

Components of language

- phonology
- grammar
- semantics
- pragmatics

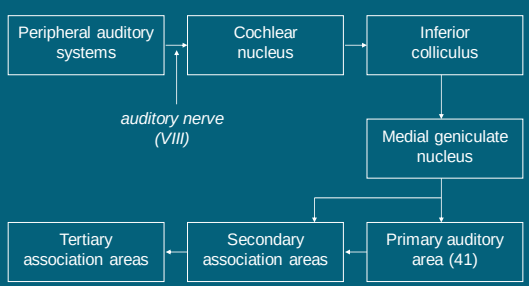
Speech comprehension

1. auditory processing
2. discriminating speech sounds
3. identifying phonemes in speech

Auditory processing

- acoustic waveform processed by the peripheral auditory system
- (note: diagnoses of language disorders exclude individuals with difficulties processing sounds)

Auditory processing



Discrimination of speech sounds

- distinguishing and classifying speech sounds, from other sounds
- this process evident in babies

Identifying phonemes

- speech does not contain discrete phonological elements (co-articulation)
- no simple correlation between a phoneme and acoustic form
- theory that phonological development reflects move from larger to smaller elements

Phonemes

- development
  - words
  - syllables
  - sub-syllabic elements (onset and rime)
  - phonemes

Grammar

- syntax
  - the principles that govern the combination of words in a language
- morphology
  - derivational morphology
  - inflectional morphology

"When 900 years old you reach, look as good you will not."

Semantics

- the manner in which individual words and more complex forms express meaning

Colourless green ideas sleep furiously.

"I owe a lot to my parents,
especially my mother and father."

Greg Norman

Pragmatics

- speech acts
- presuppositions
- conversational postulates

Language disorders

- deficits in all areas of language
- late emergence of language
- protracted development
- uneven pattern across areas
  - common pattern of grammar < phonology < semantics & pragmatics

Definitions

"slow, limited or otherwise faulty development of language in children who do not otherwise give evidence of gross neurological or psychiatric disability, and where the language difficulty is not secondary to deafness"

Zangwill (1978)

Definitions

"language development … below age level, for no apparent cause"

Bishop (1997)

Consensus definition

- language test score below criterion (eg ~81 on standardised test, ie 1.25 standard deviations)
- evidence of normal or near-normal abilities in other areas (eg >85 of "nonverbal IQ")
- normal hearing (can detect pure tones at 20 decibels in each ear at frequencies 500, 1000, 2000, 4000 Hz)
- no evidence of neurological damage (ABI, epilepsy etc)
- no abnormality of oral structure or function
- no evidence of ASD

Problems with criteria

- severity criterion
  - statistical
  - impairment
- selection of language domains
- use of nonverbal IQ
- exclusion criteria

Heterogeneity and subtypes

- characteristic weaknesses, but variation in profiles
- early classification
  - expressive
  - receptive-expressive

Other classifications

- Aram & Nelson (1975): six groups
- Wolfus et al (1980): two groups
  - poor phonology and syntax
  - global language deficits
- Korkman (1994): two groups
  - deficits in all areas
  - comprehension of complex sentences
- Rapin & Allen (1983, 1988): three groups
  - phonological-syntactic
  - lexical-semantic
  - verbal-auditory agnosia

Summary model

1. poor syntax and phonology, especially in production
2. broader profile of deficits in all areas, both comprehension and production

Prevalence

- estimates of 5 – 7%
- boy: girl ratio estimated at 2.8 : 1

Course

- studies indicate substantial continuity of language disorders
- improved long-term prognosis if language problems substantially resolved by 5 years of age, but deficits in phonology and reading evident
- poor outcome if little progress by 5 years

Common referral questions

- concern over language development
- academic problems

Language

Assessment

Purposes of assessment

- diagnosis
- prognosis
- case formulation and treatment planning
- treatment monitoring and evaluation

Types of assessment

- screening
- diagnostic assessment
- assessment of comorbid cognitive, behavioural and emotional disorders, family functioning

Common referral questions

- concern over language development
- academic problems

Issues in assessment

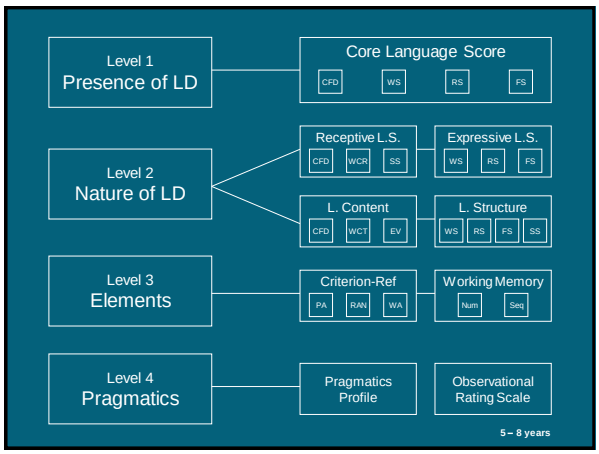
- developmental factors
- differential diagnosis
- psychometric issues

Elements

- language abilities
- intellectual abilities
- academic achievement

CELF-4

- ages 5 to 21
- 16 subtests
  - 5-8 9 subtests
  - 9-12 8 subtests
  - 13-21 9 subtests
- 6 indexes
- 4 levels of analysis



Case 50

- 6 year old girl
- history of speech and language difficulties identified in preschool
- academic difficulties on starting school

Case 50

VC	77
PR	102
WM	94
PS	107
FS	92

Case 50

VC	77	RLI	90
PR	102	ELI	65
WM	94	LCI	92
PS	107	LSI	68
FS	92	CLS	72

Does a VC < PR discrepancy predict the presence of a language disorder?

VC < PR (10+)

Sensitivity	.25
Specificity	.70
PPP	.05
NPP	.94

Does low VC and low WM predict the presence of a language disorder?

VC, WM ≤ 91 and VC < PR

Sensitivity	1.00
Specificity	1.00
PPP	1.00
NPP	1.00

Guidelines

- if both VC and WM ≤ 91 and PR>VC, probable language disorder (but consider exclusions)
- if FSIQ 80-85, don't diagnose language disorder unless > 15-20 points between FSIQ and CLS
- if FSIQ < 80, don't diagnose a (specific) language disorder

Reading

Reading

- the ability to comprehend written text
- a set of skills usually acquired in early childhood
  - phonological decoding
  - word recognition
  - text comprehension

Early identification

- importance of identifying those children who skills are weaker than peers
  - ~ 8% children are slow to develop these skills
  - ~ 2% significant and lifelong difficulties
- intervention before Year 2 maximises outcome

Overview

- reading and development
- dyslexia
  - definition
  - learning disabilities
  - neurobiology
  - cognitive aspects
  - course, comorbidity
- theories and models
- assessment
- interventions

Writing systems

- semantic
- phonological – semantic
- phonological
  - alphabets
  - syllabic alphabets

Mesopotamia, ~ 5100ya

Egypt, ~ 5000ya

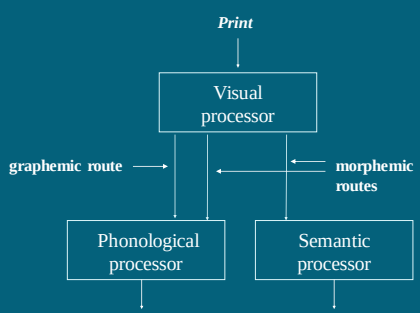
China ~ 4000ya

Indus Valley ~ 3000ya

Learning to read

- integrating a system for processing written language with a system that already exists for processing spoken language

LaBerge & Samuels (1974)



Seymour (1990)

Elements

- acquisition of alphabetic principle
- development of phonological decoding
- enhancement of lexicon

"Dyslexia is a specific learning disability that is neurobiological in origin. It is characterized by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language that is often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction. Secondary consequences may include problems in reading, comprehension and reduced reading experience that can impede growth of vocabulary and background knowledge."

International Dyslexia Association (2003)

"Dyslexia is a specific learning disability that is neurobiological in origin. It is characterized by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language that is often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction. Secondary consequences may include problems in reading, comprehension and reduced reading experience that can impede growth of vocabulary and background knowledge."

International Dyslexia Association (2003)

Specificity

- the child with a LD has a deficit in cognitive functioning which is specific to one domain, such that deficits do not extend to other areas of cognitive functioning
- e.g., the child with dyslexia has deficits specific to reading, which do not extend to other cognitive functions

Familial patterns

- son of dyslexic father has 40% risk of being dyslexic
- son of dyslexic mother has 36% risk
- daughter of dyslexic mother has 20% risk
- daughter of dyslexic father has 20% risk

Heritability

- decoding: .59 genetic, .29 environmental
- orthography: .56 genetic, .27 environmental

Genetic studies

- chromosome 15, long arm
- chromosome 6, short arm
- translocation on chromosome 1

Neuropathology

- symmetry of planum temporale
- ectopias and dysplasias

Galaburda

Neuroimaging

- symmetry of planum temporale
- differential activation in dyslexics in
  - parieto-temporal
  - occipito-temporal
  - frontal (Broca's)

Theories

- intelligence
- visual perception
  - Orton (1925)
- auditory perception
- phonological processes
  - Vellutino (1979)
- cerebellar deficit

Visual perception

- stimulus perception
  - letter reversals
- scotopic sensitivity
  - coloured lenses
- ocular muscles
- ocular dominance
- visual pathways

Letter reversals

- Orton (1925) noted that dyslexics are prone to have difficulty with reversable letters (eg, b > d)
- subsequent studies have demonstrated that reversals are less common than other errors

  Liberman et al (1971)
- reversals attributed to inexperience with reading

Coloured lenses

	number	mean effect size
NARA Accuracy	4	0.068
NARA Comp	17	- 0.093
NARA Rate	15	0.114
Total	15	0.127

Coloured lenses

	number	mean effect size
Letter identification	11	- 0.107
Word Recognition	10	- 0.101
Comprehension	11	0.105
Rate	13	0.015

Learning disabilities, including reading disabilities, are commonly diagnosed in children. Their etiologies are multifactorial, reflecting genetic influences and dysfunction of brain systems. Learning disabilities are complex problems that require complex solutions. Early recognition and referral to qualified educational professionals for evidence-based evaluations and treatments seem necessary to achieve the best possible outcome. Most experts believe that dyslexia is a language-based disorder. Vision problems can interfere with the process of learning; however, vision problems are not the cause of primary dyslexia or learning disabilities.

(continued)

Scientific evidence does not support the efficacy of eye exercises, behavioral vision therapy, or special tinted filters or lenses for improving the long-term educational performance in these complex pediatric neurocognitive conditions. Diagnostic and treatment approaches that lack scientific evidence of efficacy, including eye exercises, behavioral vision therapy, or special tinted filters or lenses, are not endorsed and should not be recommended.

A joint statement of the American Academy of Pediatrics (Section on Ophthalmology, Council on Children with Disabilities), the American Academy of Ophthalmology, the American Association for Pediatric Ophthalmology and Strabismus and the American Association of Certified Orthoptists (2009)

Sensory - Motor

	number	mean effect size
Word recognition	36	- 0.02
Comprehension	33	- 0.06
Oral reading	17	- 0.04
Vocabulary	25	- 0.01
Speed/rate	8	- 0.04

"You simply can't kill it. It simply bides its time in exile after being dislodged by one of history's periodic attacks upon it and then returns, wearing disguises or carrying new *noms de plume*, as it were, but consisting of the same old ideas doing business in the same old way".

Mann (1979)

Phonological impairment

- children with dyslexia have deficits in phonological aspects of language
- these deficits underlie poor development of reading, and deficits in certain other aspects of cognitive functioning

Phonology and working memory

- dyslexics perform poorly on tests of verbal working memory
  - digit span
  - letter span
  - word span
  - sentence repetition

Phonology and naming

- dyslexics have deficits in naming
  - confrontation
  - rapid automatised naming

Wolf (1997)

- also observed in adult dyslexics

Pennington et al (1990)

- suggests deficit in access to or retrieval of phonological code

Phonology and vocabulary

- receptive vocabulary thought to be superior to naming
- theory of "double deficit" in some dyslexics
  - phonology
  - naming

Wolf & Bowers (1999)

Phonological awareness

- verbal tasks assessing metacognitive aspects of phonology
  - tapping out or counting syllables
  - segmentation of word
  - addition or deletion of units of word
  - substitution of units
  - transposition (Spoonerisms)
  - blending

Phonological awareness

- numerous studies indicate that phonological awareness is associated with reading ability, and with the development of reading skills

Summary

- core phonological deficit
- development affected by
  - additional cognitive deficits
  - compensatory techniques employed by child
  - educational strategies
- outcome varies according to severity of deficit and effect of moderating variables

Summary

- phonological deficits are related to dyslexia
- theory: phonological deficits at the time of learning to read hamper acquisition of reading skills
- bidirectional effect

"Dyslexia is a specific learning disability that is neurobiological in origin. It is characterized by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language that is often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction. Secondary consequences may include problems in reading, comprehension and reduced reading experience that can impede growth of vocabulary and background knowledge."

International Dyslexia Association (2003)

Dyslexia and SLI

- poor decoding
  - phonology
  - "specific reading disorder"
- poor comprehension
  - grammar
  - "reading disorder - poor comprehender"
- broad deficits
  - phonology, grammar, semantics
  - "SLI" or developmental language disorder

		language disorder	"poor comprehender"	reading disorder
oral language	phonology	x	0	x
	grammar	x	x	0
	semantics	x	x	
	pragmatics	x	x	
written language	graph-phon conversion	x		x
	word recognition	x		x
	text comprehension	x	x	x
	spelling	x		x
	writing	x	x	x
memory	verbal working memory	x		x
	verbal learning	x	x	
crystallised	general knowledge	x	x	x
quantitative	arithmetic	x	x	x

Dyslexia

- primary deficits
  - phonological disorder
- secondary deficits
  - reading
  - spelling
  - writing
  - verbal fluency
  - acquired verbal knowledge
  - verbal working memory

Reading

Assessment

Assessment

- reading
  - decoding
  - word recognition
  - comprehension
- language
  - phonology
  - grammar
  - semantics
- cognition

Reading

- Neale Analysis of Reading Ability -3
- Wechsler Individual Achievement Test - II
- Wide Range Achievement Test - 4

Phonological skills

- CELF-4 phonological battery
- PAL
- PAT
- Sutherland
- NEPSY

Case 28

VC	110	RLI	115
PR	121	ELI	93
WM	83	LCI	110
PS	91	LSI	98
FS	105	CLS	98

Case 28

WR	80	MR	108
PD	91	NO	89
RC	98		
SP	87		

Treatment

- training in phonological skills improves phonological skills and reading in non-dyslexic children
- however more limited improvements in children with dyslexia
- severity of phonological deficit predicts progress

Practice guidelines

Developmental cognitive disorders

- intellectual disability
- sensory impairments
  - visual impairment
  - auditory impairment
- motor disorders
- learning disorders
  - language disorders
  - dyslexias (reading disorders)
  - dysgraphias (spelling - writing disorders)
  - dyscalculias (arithmetic disorders)
- attention-deficit hyperactivity disorder
- autistic spectrum disorders
- other disorders

Information for diagnosis

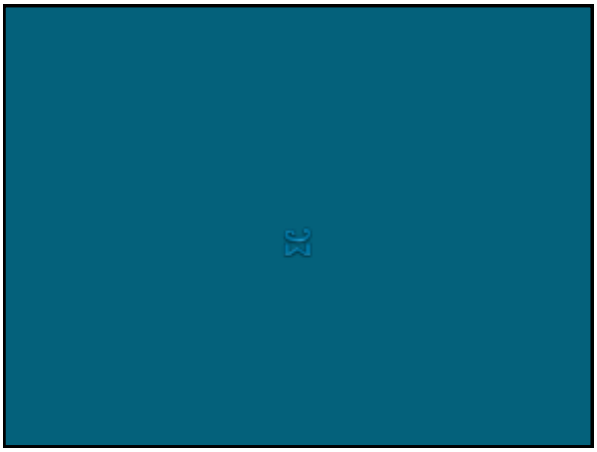
- cognitive functioning
  - language
  - intelligence
  - academic achievement
  - specific cognitive functions
- behavioural and emotional functioning
  - behavioural problems
  - mood
- social functioning
  - social interaction
  - social understanding

Test selection: minimum

- WISC-IV
- WIAT-II (reading subtests)
- BASC-2 / CBCL / CBRS

Test selection: optimal

- WISC-IV / WPPSI-III (or SB-5)
- WIAT-II (reading, spelling, arithmetic)
- CELF-4 (if concerns over language)
- BASC-2 / CBCL / CBRS
- ABAS-2 (if low IQ)
- Conners-3 (if query re ADHD)
- SSRS (if query re social functioning)
- ADI-R, ADOS, SCQ (if query re ASD)
- BRIEF (if query re executive functions)



"If (counsellors, personnel directors, psychologists and school administrators) were better informed regarding the merits and limitations of their testing instruments, they would probably be less happy and less successful in their work. The test user who has faith - however unjustified - can speak with confidence in interpreting test results and making recommendations. The well informed test user cannot do this; he knows that the best of our tests are still highly fallible instruments which are extremely difficult to interpret with assurance in individual cases...

"Consequently, he must interpret test results cautiously and with so many reservations that others wonder whether he really knows what he is talking about. Children, parents, teachers and school administrators are likely to have a greater respect and admiration for a school counselor who interprets test results with confidence even though his interpretations have no scientific justification.

"... It pays to know only a little about testing; furthermore, it is much more fun for everyone concerned - the examiner, examinee and the examiner's employer."

Buros (1961)